THE FRIDAY BURRITO Vol. XXVI #26 September 15, 2023

Time Again to Repair the World

"A true friend is the greatest of all blessings, and that which we take the least care of all to acquire."
Francois de La Rochefoucauld

"I'm a believer in belief. Faith is something that works - it causes people to do things, it has results. It's an intangible, indefinable, very real thing. And it moves people, sometimes to atrocity. And sometimes to survival."
Tommy Lee Jones

[1] **IMPORTANT NOTICE TO WPTF MEMBERS. ACTION REQUIRED: Beginning this October**, the Friday Burrito will be accessible to WPTF members by **subscription only**. The monthly fee will depend on the number of readers and email addresses listed for each respective WPTF member. For information about the monthly fee, please contact me via email. In many cases WPTF members may have a more cost-effective option subscribing to the Friday Burrito through Energy GPS. Click here to request a quote or more information

Tonight is the beginning of the Jewish New Year. For me, it marks the passage of time in a nostalgic way. Most of my immediate family does not partake in the traditions or rituals such as dipping apples into honey to begin the festivities. My son, brothers, cousins, nieces, and nephews give it scant attention. But I hold on to it because it offers solace and comfort (and time for earnest personal reflection) that I do not find in any other way. In the age of AI and overwhelming technology advancements it might seem that celebrating a religious holiday is a bother more than a blessing. For example, since this year's holiday begins on a Friday night the services are extra-long to include prayers for both the New Year and the Sabbath. However, my journey is a personal one and without the High Holidays and without long services once every several years I wouldn't feel settled. I need to feel settled in a spiritual way every so often. It tugs me out of a rut.

WAPA Moves on an SPP RTO

WPTF's consultant on West-Wide happenings, Caitlin Liotiris, shared that some entities in the Rocky Mountain region have been evaluating joining the Southwest Power Pool (SPP) Regional Transmission Organization (RTO), thereby skipping any day-ahead options such as Markets+ and the CAISO's Enhanced Day Ahead Market (EDAM). Last week the WAPA Administrator released a letter authorizing three WAPA regional entities to pursue final negotiations regarding membership in SPP's RTO-West: the Colorado River Storage Project Management Center (CRSP), Rocky Mountain region (RM), and Upper Great Plains region (UGP). Tri-State G&T, Basin Electric, Municipal Energy Agency of Nebraska, Deseret G&T, Colorado Springs Utilities, and Platte River Power Authority also are exploring membership in the SPP RTO.

Caitlin wrote: "A *FERC filing for the tariff changes for SPP to expand to RTO-West membership is expected the second quarter of 2024. There are still details to be worked out, including around a 'CRSP-pseudo-tie' to address concerns about the impacts outside of the RTO footprint. However, this marks a significant milestone for the expansion of the SPP RTO in*

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the Western Interconnection." I believe the WAPA announcement is newsworthy and Caitlin's assessment is on point. Importantly, this movement doesn't interfere with the Western day-ahead offerings that are under development.

Nuclear Fuel is Getting Pricey

Journalist John Dizard addressed the geopolitical realities facing the mining and refining of uranium in his comments before the attendees at the WPTF General Meetings both last March and a few weeks ago in Coeur d'Alene. I mentioned to John that I hadn't seen any media coverage of these price-triggering events that have caused uranium prices to skyrocket, much like natural gas prices escalated when Russia invaded the Ukraine. That is, until now. The WSJ reported this week in an article entitled, "Nukes Are Back, but Uranium Is in Short Supply," that uranium prices are soaring.

The demand for the fuel is increasing. Inactive plants such as the ones at Fukushima are returning online, and small modular reactors are growing in popularity. On the mining side, the coup in the African nation of Niger interrupted uranium shipments to France's nuclear fleet and that volume represents 5% of the global supply. According to the WSJ: "*Benchmark prices have jumped 30% this year to about $62 a pound … Barring a surge last year after Russia's invasion of Ukraine, that is their highest level since 2011, when the Fukushima meltdowns led to the shutdown of dozens of reactors … Uranium bought today will power nuclear plants from 2026 and beyond, which is when traders expect demand to start booming.*"

One additional complicating factor is the country of Kazakhstan and its national nuclear fuel production company, Kazatomprom. "*Most Kazakh uranium reaches the Western market by traveling through Russia by train before setting sail from St. Petersburg … After Russia's full-scale invasion of Ukraine in 2022 delays have hindered [an] alternative route, which wends across the Caspian Sea, through Azerbaijan and Georgia and out via the Black Sea, where Russian and Ukraine have recently traded strikes.*" All needles point to higher prices for uranium.

Why is it important in the U.S? Well, close to home as it were, PG&E is in the process of filing a licensing extension for the state's lone (operating) nuclear plant, Diablo Canyon. You can easily image that if any necessary approvals come before the Cappuccino, and they must for ratemaking purposes, then the anti-nuke league will loudly

Simply Suedeen

Click here to learn more about Suedeen Kelly

The Department of Energy just released its fourth installment in its "Pathways to Commercial Liftoff" series of investment reports on emerging green energy technologies. This one reports on Virtual Power Plants (VPPs). I love these reports for so many reasons, not least of which is they are so unexpectedly fun to read. They provide DOE's perspective, gained from "extensive stakeholder engagement" and system-level and project finance-level modeling, on how and when the subject technology can reach full-scale commercial adoption. They are written for would-be private and public investors. Each is organized around the same analytical fact base: current state of the technology (value proposition, landscape, business models); possible paths to get to scale; challenges to commercialization and potential solutions; and metrics and milestones (for those who wear the green eyeshades). Each report relates the investment DOE is making in the technology through allocation of the billions of dollars made available by the Infrastructure Investment and Jobs Act and the Inflation Reduction Act.

The VPP report, for example, explains that tripling the current scale of VPP technology (i.e., aggregations of distributed energy resources—like batteries, solar and demand response—and flexible large loads that can balance electricity demand and supply) would expand the grid's capacity 80 to 160 GW on peak and reduce grid costs by $10B/year. Now, that would be nice. And it lays out possible paths to commercial-scale VPP liftoff, including automatic enrollment of DERS into VPPs at the point of purchase, increased standardization in VPP operation, integration into utility planning and incentives, and integration into wholesale markets.

DOE's three previous Liftoff Reports covered clean hydrogen, advanced nuclear, and long duration energy storage. DOE's liftoff metaphor adds to the fun of reading the reports—understanding the forces holding back the emerging technology; overcoming them with a powerful, intentional thrust of investment dollars; getting the promising technology rocket off the ground; and, finally, steadily pumping in the fuel of markets and policy to enable it to slowly, heroically soar through the sky, transcending the pull of gravity. When I finish the report, I feel good. I hope you do too.

decry the option because of fuel-price uncertainty. I don't think that argument will carry the day, but I expect to hear it. Loudly.

Speaking of High Prices

Offshore wind energy is at a turning point that promises to sink a political dreamboat adored by lofty politicians and legislators who think energy is a plug-and-play exercise … a premise of the Grid Planning Coloring Book. Below are four credible sources that explain why it's time to rethink future reliance on offshore wind.

Bank of America/Merrill Lynch (BAML) Securities penned an opinion piece ten days ago that depicted the troubling signs facing offshore wind developments. "*[The Danish wind development company] Ørsted warned of impairing its US offshore wind assets … it still appears more likely than not that Ørsted will move ahead with … its US projects, but that there is risk that Ocean Wind 1/Sunrise could be cancelled. For the OEMs, this highlights the ongoing pressure in offshore, and we see risk that offshore revenues don't grow through 2027. GE has commented that the pricing/structure of the offshore contracts needs to improve for the company to take on new business. Vestas on the 1Q call highlighted that in offshore, PPA pricing is a challenge for developers and OEMs.*"

Western States Playbook

CAISO YTD Renewables Curtailment:

As of 8/31/23:	2,267,205 MWh
As of 8/31/22	2,195,647 MWh

% of solar and wind output curtailed relative potential renewables production:

YTD as of Aug 2023	4.92%
YTD as of Aug 2022	4.84%

CAISO Market Performance and Planning Forum: Wed 27-Sep-2023 09:00 AM - 02:00 PM. Discussion will include review of July summer performance items.

How much latitude will state public utility commissions allow utility buyers of energy from offshore projects? The landscape appears hostile. In a separate report by BAML a group of New York State utilities (referred to as the "Joint Utilities") complained that the projects were significantly underbid in the original solicitation and the results should be thrown out: "*The Joint Utilities state that there will be billions of 'massive' additional cost increase that the 'sophisticated market participants' should have reflected into their original bids. If the PSC does decide to provide additional compensation to developers, the Joint Utilities recommend that this be done on a project-by-project basis and only if the costs would be lower than from an additional subsequent procurement.*"

But BAML goes on to advise its readers: "*We have been cautious on the unregulated US offshore wind development outlook for an extended period and the landscape continues to be suboptimal …The pricing difference between natural gas, nuclear, and onshore renewables has widened to such a degree that states may begin to question the viability of the offshore industry.*"

Last month the WSJ ran an article in its business section entitled, "Wind Industry in Crisis as Problems Mount." In it, the reporters offered that, "*In recent weeks, at least 10 offshore projects totaling around $33 billion in planned spending have been delayed or otherwise hit the doldrums across the U.S. and Europe.*" That's 11,700 MW of offshore wind projects that are at risk of cancelation. That volume of cancelations will not help other offshore wind projects that fixed-price O&M agreements or in the final development stages..

In a separate WSJ article on the same topic that ran last week, entitled, "America's Wind-Farm Revolution Is Broken," it was stated that, "*The Biden administration wants to have 30 gigawatts of offshore wind capacity by 2030, from less than 50 megawatts today. Generous subsidies in the Inflation Reduction Act are meant to turbocharge investment. Ørsted hoped bonus tax credits in the climate bill for using locally produced components would paper over financial cracks, but now says its wind farms may not qualify.*" Adding to the list of problems is that wind-turbine blade manufacturers are losing money and taking write offs. According to the research firm Lazard Brothers, "*Offshore wind farms may be the most vulnerable to rising interest rates as they take longer to build and have higher upfront costs … building a U.S. offshore wind farm can cost $4,000 per kilowatt at the midpoint of estimates, compared with $1,360 for onshore farms and $1,050 for solar facilities.*"

Rough Road Ahead for New EV Sales

A number of news articles have focused on the manufacturing side of electric vehicles both in the U.S. and globally. My hunch is that consumers are hesitant to purchase an EV just for the sake of repairing the world. Three recent articles summarized below highlight different parts of the imbalances between EV supply and demand.

Last July, there were several media articles about the growing inventories for EVs. One source, the journal of Axios Media[2] ran a story entitled, "Unsold Electric Cars are Piling Up on Dealer Lots." The story isn't about Tesla cars because they seem to be selling well and don't use dealerships. It's the EVs made by the Detroit three, the German giants, and the breakthrough Chinese manufacturers. Simply put, sales aren't keeping up with that increased output. Axios reported that: "*The nationwide supply of EVs in stock has swelled nearly 350% this year, to more than 92,000 units. That's a 92-day supply — roughly three months' worth of EVs, and nearly twice the industry average. For comparison, dealers have a relatively low 54 days' worth of gasoline-powered vehicles in inventory.*"

What we believe…

1. Competition yields lower electricity rates.
2. Stable and transparent rules and regulations promote private investment.
3. Private investors, rather than utilities, will spend money on new power plants and transmission facilities if they can earn a return that is balanced with the risks.
4. Private sector investment results in lower average prices without risking consumers' money.
5. However, when IOUs do the investing, the risks to them are minimal or non-existent because ratepayers cover all the costs.
6) Overcapacity lowers electricity spot market prices; yet retail rates can increase in this case due to full cost-of-service regulation.
7) Markets work best when there are many buyers and sellers.
8) At-risk money will be put to investment where markets exist that are well regulated and yield credible prices.

Some of the EV models that are not eligible for IRA tax credits are doing incredibly poorly. Tesla price cuts have probably hurt sales, especially among the Detroit manufacturers. "*The once-hot Ford Mustang Mach-E now has a 117-day supply. Ford says that's the result of ramped-up production in anticipation of stronger third-quarter sales.*" Lotsa luck. Interestingly, hybrid models are doing very well. Shall we say that in this sector of the auto market Toyota is in the driver's seat?

German auto makers are doing the worst in the EV market. According to a recent article in the WSJ, "*Germany's automakers are slashing costs and have begun lobbying European politicians to do more to support the industry, some calling on Brussels to take back its target of banning new vehicles with internal combustion engines in 2035.*" The same shoe will drop in California re banning new sales of internal combustion engines.

The third item of note occurred in an Editorial Board piece in the WSJ. China's subsidies for its country's EV manufacturers have come back to haunt the country with oversupply. "*Auto makers are nonetheless having to slash prices to sell cars they are required to make, which is eroding margins. China's EV mandate is similar to those imposed by California and the Biden Administration and especially punishes the West's traditional fossil-fuel auto makers. The average EV price paid by consumers has fallen 20% compared with a year ago to $53,438, driven by Tesla's price cuts and dealer incentives.*

"Traditional auto makers will have to raise prices on gas-powered cars to compensate for their EV losses."

Get that message? Prices of your next internal combustion engine auto must increase to cover the manufacturers' losses in EV sales.

[2] Axios Media is a privately held company. Axios is majority-owned by Cox Enterprises, a family-owned company headquartered in Atlanta and focused on communications, automotive services, and new technologies.

Autos are entering an era of regulatory ratemaking.

Noodle Kugel with Chef Laura Manz

"*The launch of the holiday season brings celebrations with traditional dishes for special occasions. Celebrate the Jewish New Year with noodle kugel, a baked Ashkenazi Jewish pudding casserole as an indulgence and tradition.*"

Boil, cook, rinse, and drain 1 lb. of wide egg noodles. In a large bowl beat together 8 eggs, 1/3 cup sugar, 1/3 cup orange juice, 2 teaspoons vanilla extract, 1 cup of cottage cheese and ¼ tsp. of salt. Combine with prepared noodles in a large bowl. Add ½ cup of raisins and 2 apples that have been cored, peeled, and chopped. Combine with 1/3 cup of melted unsalted butter. Greased a 9" x 13" casserole dish, add the noodle mixture and bake at 350° 1 hour. Test for doneness by inserting a clean knife. If it comes out clean, remove the kugel from the oven and cool for approximately one hour before serving.

Bless your heart, Laura, for that recipe and a Happy New Year to you and your family. I have fond memories of both my mom and grandmother making this dish. However, once when I was visiting my parents for the holiday, I watched my mom prep her kugel and I saw the amount of sugar that went into it. It spoiled my enjoyment of the dish although it was sweet and delish. Let's just say I eat it sparingly when offered … and I go for the crusty corners in the baked casserole dish. Same for home-made brownies.

Things in the People's Republic of California

The Policy Versus the Plan

Those who follow the ongoing integrated resource planning exercises at the CPUC appreciate the mayhem that accompanies the interactions between abstract modeling of the future California grid to meet reliability and greenhouse gas emission goals, and the plans to achieve those goals as submitted by the jurisdictional entities. I don't often dip into this stuff anymore because it exhausts me to study the assumptions, the modeling results, the definition of a preferred resource portfolio, and ultimately the impact on the transmission plans developed by the CAISO.

However, one thing that has recently been brought to my attention is the rapidly changing outlook based on recent information. In short, in a period of six short months during which the load-serving entities filed their respective resource plans the aggregated generic resource mix has flipped a bit, significantly down for solar and battery energy storage. It begs the question, why?

`… and, what we should do:

1. Believe in ourselves.
2. Encourage creation of independent, multi-state regional transmission organizations that coordinate policies with respective state utility commissions.
3. Support rules for resource adequacy that applies uniformly among all load-serving entities.
4. Enforce competitive solicitations by utilities for purchasing either thermal or renewable power.
5. Support choice among retail electricity customers.
6. Lobby for core/non-core split of retail customers.
7. Advocate against policies that limit, through bid mitigation, merchant returns on investment that are utility-like returns.

Let's first look at the capacity additions that the CPUC approved last February as the base case portfolio. I'm only going to focus on generic resources that are central to the net-zero debate. Specifically: wind (in-state plus out-of-state), offshore wind, solar, and battery storage. In the February Order, the Cappuccino described the base case as follows: "*A portfolio that meets a 30 million metric ton (MMT) GHG target in 2030, with load assumptions based on the CEC's IEPR Additional Transportation Electrification (TE) Load Scenario. This is a portfolio with more resources required to serve more load than was adopted as the PSP to be used by LSEs to plan for their most recent individual IRPs filed on November 1, 2022. The portfolio includes approximately 86 GW of new resources by 2035, on top of the existing resource mix on the electric grid*

of approximately 75 GW. This is more than a doubling of nameplate capacity on the system within 12 years." I know. It sounds ridiculous. But that has been the story from the start. So, we take it as we find it.

Feb 2023 Order Capacity Additions (MW)	2026	2030	2033	2035
Battery Storage	11,145	13,529	21,738	28,381
Solar	11,073	21,367	32,025	39,072
Wind	4,176	9,656	9,656	9,656
Offshore Wind	120	3,100	3,261	4,707

The table on the left was the CPUC's modeling attempt at meeting the targets of grid reliability and GHG emissions of 30 MMT as approved last February for procurement solicitations.

Since that time, each of the jurisdictional load-serving entities (LSE) has developed and filed their plans for meeting the gross targets for their respective systems. Less modeling, more noodling, after all this is an art not a science. The Cappuccino staff reviewed the individual filings, aggregated them, and revised its modeling effort to blend a touch of reality with the modeling. Here are the results that were published (not a Commission Order but simply an update to keep the process transparent) as shown in the table below:

Aug Updated Capacity Additions (MW)	2026	2030	2033	2035
Battery Storage	8,522	12,920	15,576	18,849
Solar	5,539	15,211	16,528	19,418
Wind	2,495	7,212	7,312	7,946
Offshore Wind	0	1,580	3,331	4,531

Difference in Capacity Additions (MW)	2026	2030	2033	2035
Battery Storage	(2,623)	(609)	(6,162)	(9,532)
Solar	(5,534)	(6,156)	(15,497)	(19,654)
Wind	(1,681)	(2,444)	(2,344)	(1,710)
Offshore Wind	(120)	(1,520)	70	(176)

Were there any differences? Yes, and how. The next table down on the left shows them. The solar fleet additions have been clipped by a factor of two by the time 2035 rolls around. Battery energy storage systems also get slashed. What do these interim results say about the value of solar and battery storage in terms of reducing greenhouse gas emissions? It says they have limited impact after a certain point.

Consider the reality of solar. The marginal effect of an additional MW of solar of course has a small impact on reliability especially as the net peak has moved into the twilight hours (is that like the Twilight Zone?). Even during daylight hours there is excess solar production that is either curtailed or exported out of the CAISO to neighboring balancing authorities.

With respect to batteries, more capacity doesn't alter the capacity mix when charging or discharging. It does marginally impact the dispatch. For example, batteries that are discharging must displace a lot of gas fired generation in order to garner a bit of GHG reduction. Let's agree, that displacing zero-emitting resources at the margin doesn't change the needed resource procurement and, therefore, more battery storage has limited effect on GHG emissions.

On the good-news side, there is a possibility that higher capacity factors for out-of-state wind and dare I say it, offshore wind, have a significant impact on the modeling results. Greater volume of zero-emission energy from these resources across a wider diurnal window might reduce the need for some of the solar and battery storage capacity. That's a steep what-if.

However, all said, wouldn't the magnitude of changes in the revised base plan also alter the transmission plan developed by the CAISO? It almost turns on its head the integrated-planning handoff between the CPUC and the CAISO.

Grand Phunk Salsa a la Energy GPS

Where to Put the E in Scarcity?

In late August, the CAISO filed the long-awaited tariff amendments for the Day-Ahead Market Enhancements and the Extended Day-Ahead Market, known as DAME and EDAM, respectively. Let's start with the fact that it's confusing that they used the same letters for each acronym, with "DAM" as the root of the acronym and the "E" sitting either at the beginning or the end. With Wordle on my mind each day, it's like EDAM is my second guess in Wordle and the correct answer is

DAME which I get on my third guess. With years and years of stakeholder processes under their belt, shouldn't the CAISO have a Business Practice Manual which provides guidance on the use of clear and distinct acronyms?

At Energy GPS we are making our way through the 1200+ page filing. It's a big one! There is so much to discuss about this filing, including new reserve products (attention BESS operators), payments to transmission owners for lost transmission revenues, rules around resource sufficiency to participate in the day-ahead market, impacts on basis in the day-ahead market that aren't in real-time, and much, much more. In the coming weeks, both WPTF's CAISO Committee managed by Carrie Bentley and our firm, Energy GPS, will be digging into the key topics in the filing.

If the tariff filing is approved by FERC, albeit after some modifications that FERC may require, there are a number of pricing impacts on Western markets that stand out to me. One of them will be the impact of shifting from bilateral market price formation to CAISO price formation. In the current bilateral markets, say at Mid-Columbia or Palo Verde, generators must recover their full marginal cost from their sales price. If output from a generator is required to clear the market, the ICE price must move high enough to cover: (a) the cost of natural gas, (b) variable O&M, as well as (c) startup costs and (d) any losses incurred during hours that the unit is running while out of the money. If the ICE price doesn't cover those costs the generator will not run.

It works differently in the CAISO. While the CAISO includes all of the above costs when determining the lowest-cost dispatch, the CAISO has a separate "pricing run" where startup and minimum operating costs are excluded from the LMP. The CAISO simply makes a side payment to generators to cover these costs. Other things equal, when price is formed via the CAISO process it will be lower than prices when formed via bilateral markets – even if the dispatch is the exact same. The CAISO stands apart from every other RTO in the country on this point. Energy GPS did much of the primary research for a paper released by Powerex and the Public Power Council in June of 2022 which describes this issue in detail. The paper explains that standard FERC policy is to include startup and minimum run costs for fast-start units in the LMP. Every RTO in the land, except CAISO, has adopted this policy over the last several years. By including these costs, LMPs move up modestly and demand receives an accurate price signal. The CAISO does not include startup costs in its LMP. Instead, the CAISO makes side payments to generators to compensate them for the startup costs while excluding these costs from the LMP. The CAISO, with the full-throated backing of the CPUC, has a long history of suppressing LMPs and this is just one example.

If you compare the CAISO Energy Imbalance Market (EIM) LMPs in the Northwest and the Southwest to ICE, day-ahead, cash hub prices (for the relevant peak or off-peak block hours), you will see that ICE trades at a material premium to the EIM. Part of this is because by the time the EIM has come around, the participating Balancing Authorities have already dealt with unit commitment and resolved any scarcity. The EIM is truly a "leftovers" market for Balancing Authorities who have already balanced supply and demand on their own. However, the ICE price also has startup costs embedded in it and, it may have a scarcity premium which sellers are sometimes able to extract when market conditions are tight. The CAISO price formation will remove the startup costs and the CAISO market power mitigation may remove any scarcity premium. I'm expecting the CAISO EDAM prices at Mid-Columbia and Palo Verde will come in below the ICE prices at the same locations. Whether the EDAM will trade at a premium to the real-time EIM remains to be seen. Some sellers will be able to only access ICE. Other sellers will be able to access both the CAISO and ICE. It will be interesting to see how the chips fall once the EDAM is approved and gets going.

The above Op Ed is from the team at Energy GPS with Tim Belden as the lead writer.

Shout Outs and Murmurs (👀 & 👂)

Anita Decker sent this note regarding the CAISO EDAM confab in Las Vegas two weeks ago: "*I very much appreciated the WPTF and EDAM Forum coverage. My own personal opinion is, if as leaders around and across the industry, e.g., Commissions, CEOs of IOUs, Munis, Public Power, Co-ops, Trade Organizations, can't get to one West-wide market – then shame on us.*

"Having been personally in people's home who could not pay their bill, the focus has to be on the end user – not the generators or individual utility interest.

"I truly hope we get there – knowing full well that hope is not a plan!"

A positive message, Anita. Thanks.

Jan Strack provided this reply to Dan Walter's letter last week that was a response to Randy Hardy's last column on the efficacy of multiple regional transmission operators: "*Perhaps a small point in the big scheme of things, but it is often overlooked that the West already has two functioning Day Ahead centralized markets: One run by the California Independent System Operator and the other by the Alberta Electric System Operator (AESO).*"

I don't often think about the AESO, Jan, but thanks for the reminder.

Dave Braun did a back of a napkin analysis regarding the likelihood of fusion energy being commercially operative in our lifetimes. It was based on a debate he was having on the topic with a colleague: "*Fusion is a pipe dream, and here is why: Using hydrogen as the feedstock, the electrolysis process alone is only 70% efficient. Additionally, if we include a 10% transportation and storage losses then we have 40% losses which means the yield from the Fusion reactor must be 1.67 or 67% greater than what is put in to make the reaction sustainable from the original hydrogen fuel.*

"For over two decades, since 1997, the record for the fusion energy gain factor, Q, was held by JET at Q = 0.67. The record for Q_{ext} was held by JT-60, with Q_{ext} = 1.25, slightly besting JET's earlier Q_{ext} = 1.14. In December 2022, the National Ignition Facility reached Q = 1.54 with a 3.15 MJ output from a 2.05 MJ laser heating, which remains the record as of 2023.

*"Reactions which have not been sustained have only been in the 15% to 30% yield range until a recent Q=1.54 (54%) however this was not sustained. Additionally, the reaction does not include heat extraction with a Rankine cycle of 30-40% which means the Q must = 1.67*2.5 (@40%) = 4.175. It took 26 years to go from 0.67 to 1.54. At that rate of progress, it would take another 80 years to reach a non-sustainable reaction of Q=4.175.*

"We are many decades to a century or more if ever away from that level."

That wins the Burrito award for most technical letter received. Ever. I'm down with Fusion in 2323.

Our final letter is from an anonymous source: "*Picking up on your section entitled 'Climate Beckons Faith' in last week's Burrito, I was deeply troubled to see this massive banner in one of Vancouver's major public transportation hubs:*

"While I respect freedom of speech, I am hoping that advertisements like this mark the beginning of the end of the hysteria and swing the pendulum back to where informed conversation can take place. It's troubling that what is being fueled causes the most anxiety in our young people.

"That 'chaos' should stop!"

Odds & Ends (_!_)

Beginning this October, the Friday Burrito will be accessible to WPTF members **by subscription only.** The monthly fee will depend on the number of readers and email addresses listed for each respective WPTF member.

The monthly charges are $150 (1 reader) to $750 (10 to 20 readers). Subscriptions for more than 20 readers will be serviced by Energy GPS with a fee bilaterally negotiated with Energy GPS.

For Burrito recipients via WPTF, the invoicing and payment will be managed by Frank McDonald in the same way in which WPTF invoices for the WPTF Committees.

If you are interested in subscribing to the Burrito, please email me

For you folks who get the meat-filled version of the Burrito (Note: after this month everyone who subscribes will get the meat-filled version), below are your stories:

That's a wrap. Happy, Healthy and Sweet New Year to all who celebrate and we'll visit again next week.

gba